

Listing of the Claims

1. (Currently Amended) A magnetic field gradient coil for a short-bore magnetic resonance imaging scanner, the gradient coil comprising:

upper and lower magnetic field gradient coil windings (~~70, 72, 74, 76, 102, 104, 112, 114~~) that define a subject-receiving bore (~~44~~) and which generate transverse magnetic field gradients imposed on an associated static magnetic field generally oriented in a longitudinal direction through the bore, the upper gradient coil winding (~~70, 74~~) having an arcuate curvature (C_{upper}) transverse to the longitudinal direction and a longitudinal length (L_{upper}) in the longitudinal direction that is smaller than a longitudinal length (L_{lower}) of the lower gradient coil winding (~~72, 76~~).

2. (Currently Amended) The gradient coil as set forth in claim 1, further including:

a coil support including an upper section (~~40~~) supporting the upper magnetic field gradient coil winding (~~70, 74~~) and a lower section (~~42~~) supporting the lower magnetic field gradient coil winding (~~72, 76~~).

3. (Currently Amended) The gradient coil as set forth in claim 2, wherein the upper and lower magnetic field gradient coil windings (~~70, 72, 74, 76~~) include:

primary coil windings (~~70, 72~~) disposed on coil bore-defining surfaces (~~52, 56~~) of both the upper and lower sections (~~40, 42~~) of the coils support; and

shield coil windings (~~74, 76~~) disposed on outer surfaces (~~50, 54~~) of both the upper and lower sections (~~40, 42~~) of the coils support.

4. (Currently Amended) The gradient coil as set forth in claim 3, further comprising:

connecting conductors (~~82~~) extending across an edge (~~62~~) of the lower section (~~42~~) between the coil bore-defining surface (~~56~~) and the outer surface (~~54~~), the connecting conductors (~~82~~) electrically connecting the primary and shield coil windings (~~72, 76~~).

5. (Currently Amended) The gradient coil as set forth in claim 1, wherein:

the arcuate curvature of the upper gradient coil windings ~~(70, 74)~~ lies generally along a portion of a circular or oval cross-section; and

the lower gradient coil windings ~~(72, 76)~~ include primary windings ~~(72)~~ that are substantially planar compared with the arcuate curvature (C_{upper}) of the upper gradient coil windings ~~(70, 74)~~.

6. (Currently Amended) The gradient coil as set forth in claim 5, wherein the

lower gradient coil windings ~~(72, 76)~~ further include

shield coil windings ~~(76)~~ lying generally along an arcuate curvature matching the arcuate curvature (C_{upper}) of the upper coil windings ~~(70, 74)~~ such that the upper gradient coil windings ~~(70, 74)~~ and the shield coil windings ~~(76)~~ of the lower gradient coil windings ~~(72, 76)~~ have one of a circular cross-section and an oval cross-section.

7. (Currently Amended) The gradient coil as set forth in claim 6, wherein the

upper coil windings ~~(70, 74)~~ further include:

primary coil windings ~~(70)~~ and shield coil windings ~~(74)~~ each defining curved surfaces having the arcuate curvature (C_{upper}), the defined curved surfaces being spaced apart a separation distance transverse to the longitudinal direction;

connecting conductors ~~(80)~~ disposed at longitudinal ends of the upper coil windings ~~(70, 74)~~ and electrically connecting the primary coil windings ~~(70)~~ and the shield coil windings ~~(74)~~ by spanning the separation distance along a flared annular connecting surface ~~(60)~~ having an angle other than 90° respective to the longitudinal direction.

8. (Currently Amended) The gradient coil as set forth in claim 1, wherein the

longitudinal length (L_{upper}) of the upper gradient coil windings ~~(70, 74)~~ is about the same as or less than a dimension of the coil bore ~~(44)~~ transverse to the longitudinal direction.

9. (Currently Amended) The gradient coil as set forth in claim 8, wherein a

ratio of the longitudinal length (L_{upper}) of the upper gradient coil windings ~~(70, 74)~~ to the dimension of the coil bore ~~(44)~~ transverse to the longitudinal direction is less than or about 0.7.

10. (Currently Amended) The gradient coil as set forth in claim 1, wherein the magnetic field gradient coil windings ~~(70, 72, 74, 76)~~ include:

a first sub-set of the windings that when energized produce a first magnetic field gradient oriented transverse to the longitudinal direction and parallel to a plane of bilateral symmetry ~~(58)~~ of the gradient coil windings ~~(70, 72, 74, 76)~~; and

a second sub-set of the windings that when energized produce a second magnetic field gradient oriented transverse to the longitudinal direction and transverse to the plane of bilateral symmetry ~~(58)~~ of the gradient coil windings ~~(70, 72, 74, 76)~~.

11. (Currently Amended) The gradient coil as set forth in claim 10, wherein the first magnetic field gradient has a zero-field point ~~(86)~~ displaced toward the upper gradient coil winding ~~(70, 74)~~ relative to an imaging volume ~~(16)~~ that is surrounded by the gradient coil.

12. (Currently Amended) The gradient coil as set forth in claim 1, wherein the magnetic field gradient coil windings ~~(102, 104, 112, 114)~~ include:

a first sub-set ~~(102, 104)~~ of the windings that when energized produce a magnetic field gradient ~~(106)~~ in a first direction oriented transverse to the longitudinal direction and at a 45° angle to a plane of bilateral symmetry ~~(58)~~ of the gradient coil windings ~~(70, 72, 74, 76)~~; and

a second sub-set ~~(112, 114)~~ of the windings that when energized produce a magnetic field gradient in a second direction transverse to the longitudinal direction and transverse to the first direction.

13. (Currently Amended) A magnetic resonance imaging scanner comprising:

a housing ~~(10)~~ having: (i) an imaging volume ~~(16)~~ imaged by the scanner and (ii) an imaging subject support section ~~(20)~~ disposed below the imaging volume ~~(16)~~, the imaging subject support section ~~(20)~~ extending beyond a length (L_{home}) of a magnet bore;

a radio frequency coil ~~(28)~~ arranged to inject a radio frequency signal into the imaging volume ~~(16)~~; and

a magnetic field gradient coil ~~(30, 100)~~ including a lower section ~~(42)~~ disposed in the imaging subject support section ~~(20)~~ of the housing ~~(10)~~ and an upper section ~~(40)~~ that together with the lower section ~~(42)~~ define a coil bore ~~(44)~~ containing the imaging volume

~~(16)~~, the upper section ~~(40)~~ having an arcuate curvature ~~(C_{upper})~~ and coil windings ~~(70, 74)~~ spanning a first length ~~(L_{upper})~~, the lower section ~~(42)~~ having coil windings ~~(72, 76)~~ spanning a second length ~~(L_{lower})~~ greater than the first length ~~(L_{upper})~~.

14. (Currently Amended) The imaging scanner as set forth in claim 13, wherein the coil windings ~~(70, 72, 74, 76)~~ of the magnetic field gradient coil ~~(30)~~ include:

a first set of windings that when energized produce a vertical magnetic field gradient imposed on an associated generally horizontal magnetic field at least in the imaging volume ~~(16)~~.

15. (Currently Amended) The imaging scanner as set forth in claim 14, wherein the vertical magnetic field gradient has a zero-field point ~~(86)~~ displaced vertically upward relative to the imaging volume ~~(16)~~.

16. (Currently Amended) The imaging scanner as set forth in claim 14, wherein the magnetic field gradient coil windings ~~(70, 72, 74, 76)~~ further include:

a second set of windings that when energized produce a horizontal magnetic field gradient imposed on the associated generally horizontal magnetic field at least in the imaging volume ~~(16)~~.

17. (Currently Amended) The imaging scanner as set forth in claim 13, wherein the magnetic field gradient coil windings ~~(70, 72, 74, 76)~~ when energized produce one or more magnetic field gradients imposed on an associated generally horizontal magnetic field at least in the imaging volume ~~(16)~~, the magnetic field gradient coil windings including at least:

a first set of windings ~~(102, 104)~~ that when energized produce a first magnetic field gradient ~~(106)~~ oriented at a 45° angle to the horizontal; and

a second set of windings ~~(112, 114)~~ that when energized produce a second magnetic field gradient ~~(116)~~ oriented at a 45° angle to the horizontal and oriented transverse to the first magnetic field gradient ~~(106)~~.

18. (Currently Amended) The imaging scanner as set forth in claim 13, wherein the second length (L_{lower})-spanned by coil windings of the lower section (42)-is greater than the bore length (L_{bore}).

19. (Currently Amended) The imaging scanner as set forth in claim 13, wherein the radio frequency coil (28)-includes:

a generally planar lower section (28₁)-disposed in the imaging subject support section (20)-of the housing-(10); and

an arcuate upper section (28₂)-that together with the lower section (28₁)-define a radio frequency coil bore contain the imaging volume-(46).

20. (Currently Amended) A method of magnetic resonance imaging, the method comprising:

generating a main magnetic field through a subject receiving bore-(14);
generating magnetic field gradients across the bore (14)-with a combination of (i) upper gradient coils (70, 74)-that have a first longitudinal length (L_{upper})-shorter than a diameter (D_{bore})-of the bore (14)-and (ii) lower gradient coils (72, 76)-that have a second longitudinal length (L_{lower})-longer than the diameter of the bore-(14).